

GEPHE SUMMARY

Gephebase Gene

Zmr1

Entry Status

Published

GepheID

GP00001715

Main curator

Courtier

PHENOTYPIC CHANGE

Trait #1

Trait Category

Physiology

Trait

Xenobiotic resistance (fungicide)

Trait State in Taxon A

high melanin levels - lower growth rate in absence of fungicide - higher growth rate in presence of fungicide

Trait State in Taxon B

low melanin levels - higher growth rate in absence of fungicide

Trait #2

Trait Category

Physiology

Trait

Melanin content

Trait State in Taxon A

high melanin levels - lower growth rate in absence of fungicide - higher growth rate in presence of fungicide

Trait State in Taxon B

low melanin levels - higher growth rate in absence of fungicide

Ancestral State

Data not curated

Taxonomic Status

Intraspecific

Taxon A

Latin Name

Zymoseptoria tritici

Common Name

-

Synonyms

Zymoseptoria tritici (Desm.) Quaedvlieg & Crous 2011; CBS 115943; CBS:115943; IPO 323; IPO:323

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Fungi; Dikarya; Ascomycota; saccharomyceta; Pezizomycotina; leotiomyceta; dothideomyceta; Dothideomycetes; Dothideomycetidae; Capnodiales; Mycosphaerellaceae; Zymoseptoria

Parent

Zymoseptoria () - (Rank: genus)

NCBI Taxonomy ID

1047171

is Taxon A an Intraspecies?

Yes

Taxon A Description

strain 3D7

Taxon B

Latin Name

Zymoseptoria tritici

Common Name

-

Synonyms

Zymoseptoria tritici (Desm.) Quaedvlieg & Crous 2011; CBS 115943; CBS:115943; IPO 323; IPO:323

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Fungi; Dikarya; Ascomycota; saccharomyceta; Pezizomycotina; leotiomyceta; dothideomyceta; Dothideomycetes; Dothideomycetidae; Capnodiales; Mycosphaerellaceae; Zymoseptoria

Parent

Zymoseptoria () - (Rank: genus)

NCBI Taxonomy ID

1047171

is Taxon B an Intraspecies?

Yes

Taxon B Description

strain 3D1

GENOTYPIC CHANGE

Generic Gene Name

CMR1

UniProtKB *Cochliobolus heterostrophus*

Q06F33

Synonyms

-

GenebankID or UniProtKB

String

-

Sequence Similarities

-

GO - Molecular Function

GO:0008270 : zinc ion binding

GO:0003677 : DNA binding

GO:0000981 : DNA-binding transcription factor activity, RNA polymerase II-specific

GO - Biological Process

GO:0006351 : transcription, DNA-templated

GO - Cellular Component

GO:0005634 : nucleus

Mutation #1**Presumptive Null**

No

Molecular Type

Cis-regulatory

Aberration Type

Insertion

Insertion Size

10-100 kb

Molecular Details of the Mutation

insertion of a transposable element island (13 TE interspersed by simple repeats) of approximately 30 kb, located 1862 bp upstream of Zmr1 start codon - analysis of knock out lines of the TE island insertion

Experimental Evidence[Linkage Mapping](#)**Main Reference**[Transposable element insertions shape gene regulation and melanin production in a fungal pathogen of wheat. \(2018\)](#)**Authors**

Krishnan P; Meile L; Plissonneau C; Ma X; Hartmann FE; Croll D; McDonald BA; SÁinchez-Vallet A

Abstract

Fungal plant pathogens pose major threats to crop yield and sustainable food production if they are highly adapted to their host and the local environment. Variation in gene expression contributes to phenotypic diversity within fungal species and affects adaptation. However, very few cases of adaptive regulatory changes have been reported in fungi and the underlying mechanisms remain largely unexplored. Fungal pathogen genomes are highly plastic and harbor numerous insertions of transposable elements, which can potentially contribute to gene expression regulation. In this work, we elucidated how transposable elements contribute to variation in melanin accumulation, a quantitative trait in fungi that affects survival under stressful conditions.

We demonstrated that differential transcriptional regulation of the gene encoding the transcription factor Zmr1, which controls expression of the genes in the melanin biosynthetic gene cluster, is responsible for variation in melanin accumulation in the fungal plant pathogen *Zyromyces tritici*. We show that differences in melanin levels between two strains of *Z. tritici* are due to two levels of transcriptional regulation: (1) variation in the promoter sequence of Zmr1 and (2) an insertion of transposable elements upstream of the Zmr1 promoter. Remarkably, independent insertions of transposable elements upstream of Zmr1 occurred in 9% of *Z. tritici* strains from around the world and negatively regulated Zmr1 expression, contributing to variation in melanin accumulation.

Our studies identified two levels of transcriptional control that regulate the synthesis of melanin. We propose that these regulatory mechanisms evolved to balance the fitness costs associated with melanin production against its positive contribution to survival in stressful environments.

Additional References**Mutation #2****Presumptive Null**

No

Molecular Type

Cis-regulatory

Aberration Type

SNP

Molecular Details of the Mutation

several candidate SNP - tests using reporter transgenes

Experimental Evidence[Linkage Mapping](#)**Main Reference**[Transposable element insertions shape gene regulation and melanin production in a fungal pathogen of wheat. \(2018\)](#)**Authors**

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[Additional References](#)

RELATED GEPHE

[Related Genes](#)

No matches found.

[Related Haplotypes](#)

No matches found.

EXTERNAL LINKS

COMMENTS

@TE ; check for UniProtKB and orthology with Cmr1